PATENT SPECIFICATION

NO DRAWINGS

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A diesel fuel.

COMPLETE SPECIFICATION

We, AB NYAS-PETROLEUM, of Oljeraffinaderiet, Nynäshamn, Sweden, a Swedish Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be perfeormed, to be particularly described in and by the following statement:—

THE PRESENT INVENTION relates to a diesel fuel oil. More particularly the invention relates to a volatile diesel fuel oil which consists essentially of a mixture of hydro carbons wherein the bulk of the hydrocarbons have boiling points lower than about 300°C, said diesel fuel oil being capable of forming, when submitting it to combustion in a diesel motor, combustion gases having a low content of smoke, but having in itself an insufficient oiliness for the injection pump of the diesel motor to function properly.

The object of the present invention is to provide a diesel fuel oil of the type referred to which while functioning satisfactorily in respect of ability of forming little smoke when burnt in a motor does not give any injurous effects on the pumps used for the injection of the fuel oil.

Another object of the invention is to provide a diesel fuel oil of the type referred to the combustion of which results in no, or in only minor, formation of smoke and the use of which gives rise to no, or only a slight, wearing in respect of the movable parts of the diesel motor pump, which fuel oil also has a sufficient low cloud point to render it proper for use under severe climatic conditions without any fears resulting that the fuel filters and the injection nozzles of the diesel motor will clog to precipitated crystals of addition agents.

In order that a diesel fuel oil may be accepted as a saleable product it has to meet a number of requirements, which are set forth in Standard specifications (see ASTM D975 No. 1-D and D975-59/T). As a rule, a mineral oil distillation process can easily be so adjusted that it gives a hydrocarbon fraction which is suitable as a diesel fuel provided the crude oil is a suitable one and the diesel oil has only to fulfil the standard requirements of diesel fuels concerning flash point (at least 38°C), cetane number (at least about 40) etc.

In recent times attention has been directed to one property of diesel fuels, namely, their ability to burn with a smoke formation as low as possible. In towns and other densely populated communities it is necessary that motor buses and loading vehicles and trucks discharge the combustion gases of their motors with as little smoke formation as possible. Furthermore, it is most necessary in mines that truck vehicles discharge the combustion gases of their motors without development of too much smoke injurious to the miners.

From a principal point of view, it is rather obvious that a diesel fuel oil consisting of relatively easily volatile hydrocarbons will as a rule give less smoke-containing combustion gases than a diesel fuel composed of relatively difficulty volatile hydrocarbons under otherwise similar conditions. Experiments have been carried out with, on one hand, a commercial diesel fuel composed of hydro carbons having boiling points in the range from 180 to 360°C, and, on the other hand, with a hydrocarbon fraction of the boiling point interval from 150 to 280°C and these experiments have confirmed this view.

However, it has proved that the oiliness of an otherwise acceptable diesel fuel oil which is composed of hydrocarbons having sufficiently low boiling points to give an acceptable, decreased content of smoke in their discharged combustion gases, is not high enough to prevent heavy wearing of the machine elements of the diesel motor fuel pumps. This disadvantage of the fuels has up to the present represented an impossible obstacle to a more common expansion and

(Price 4s. 6d.)

general use of easily volatile diesel fuel oils for the purpose of driving diesel motor vehicles.

In this connection it may be mentioned that trials have been made to incorporate lubricating oils in such diesel fuel oils, but it did not, in spite of additions amounting to up to 5 per cent, prove possible to attain an improvement in respect of the oiliness of the diesel fuel oils, and the addition of the lubrication oil rather resulted in combustion gases containing a good deal of soot.

The object of providing a diesel fuel oil which when burning it in a a diesel motor gives combustion gases having an acceptably low content of smoke while having sufficient oiliness to prevent a wearing-out of the movable parts of the diesel motor pump or pumps is attained by incorporating in the oil a straight chain saturated aliphatic hydrocarbon carboxylic acid containing from 12 to 18, inclusive, carbon atoms in its molecule in an amout corresponding to a content of from 0.02 weight per cent to 0.1 weight per cent based on the weight of diesel fuel oil.

Preferred amounts of the addition agent according to the invention correspond to at least 0.05 weight per cent, based on the weight of diesel fuel oil.

As a rule, no essential improvements of oiliness are obtained for higher amounts than a 0.0 weight per cent of the addition agent, based on the weight of diesel fuel oil.

Preferred additives according to the invention are lauric, palmitic and stearic acids.

It may be mentioned that the improvement of the oiliness of the diesel fuel oil is a specific one which is ascribed to the addition agents according to the invention.

It may furthermore be pointed out that unsaturated carboxylic acids, such as oleic, abeitic, linoleic and linolenic acids, besides giving no improvement of the oiliness when incorporated in a diesel fuel oil, moreover may be injurious to the diesel fuel oil in that they may give rise to polymerisation with formation of resins and similar products. Such products precipitate in the diesel fuel oil and may clog the nozzles of the injection pumps. Moreover, it has proved that such unsaturated carboxylic acids usually give rise to corrosion of the tanks, the fuel supply ducts and the diesel motor pumps.

Consequently, the content of unsaturated carboxylic acids in the diesel fuel oil according to the invention should be kept as low as possible which usually means that no more than minor amounts or, preferably traces, of these acids are permitted in the diesel fuel oil.

In spite of the fact that the saturated compounds according to the invention are acids it has surprisingly been found that they do not give any injurious corrosive effects.

A valuable new-found property of the additives used according to the present invention is that, provided they are added in amounts corresponding to contents between 0.02 and 0.10 per cent, they do not substantially influence the cloud point of the diesel fuel oil. This effect has proved particularly pronounced for contents in the range of from 0.05 to 0.10 per cent, of the additive, based on the diesel fuel oil.

Straight chain saturated aliphatic hydrocarbon carboxylic acids having a number of carbon atoms below 12 in their molecules present, when incorporated in the diesel fuel oil, a number of undesirable side effects, particularly corrosion of the metal parts of the pumps with which the diesel oil comes in contact when it is to be injected in the combustion chambers. Straight chain saturated aliphatic hydrocarbon carboxylic acids having a number of carbon atoms exceeding 18 nave insufficient oiliness-improving properties in respect of the diesel fuel oil when incorporated therein.

The effect obtained according to the invention can thus be said to be a specific one in respect of the carboxylic acid set forth above.

A valuable specific application of the present invention refers to the providing of diesel fuel oils to be used under severe climatic conditions such as prevail during the winter in Sweden and Canada. In respect of such diesel fuel oils it is very important that they possess low cloud points as otherwise the nozzles of diesel motors may clog due to precipitated wax and resins.

For this purpose a diesel fuel oil fraction having a cloud point below about −40°C or, if the conditions under which the fuel is to be used are expected to be very severe, preferably below −50°C, meeting requirements of diesel fuels for the rest and consisting essentially of hydrocarbons boiling below about 300°C is used as the basic product, and to this basic product is added a straight, saturated hydrocarbon carboxylic acid containing from 12 to 14, inclusive, carbon atoms, preferably lauric acid.

This acid can be added in amounts corresponding to contents up to 0.10 per cent without any change of the cloud point in an unfavourable direction occurring, and the diesel fuel oil thus obtained may be confidently used under severe climatic conditions, such as prevail in arctic areas during the winter.

The diesel fuel oils containing the additives according to the invention may also have a cetane-number improving agent incorporated therein. As examples of suitable agents of this type may be mentioned: amyl nitrate, isopropyl nitrate, and nitro-methane.

Of course, it has previously been suggested to use stearic aicid as a lubrication improving agent, but in that connection the stearic

acid was to be used as an addition agent to lubricating oils. From this suggestion it was not, however, possible to conclude that the acid should be suitable as an addition agent to diesel fuel oils and still less as an addition agent to diesel fuel oils of the type which burn with formation of gases with a low content of smoke.

EXAMPLES

The following examples are illustrative but not limitative of preferred embodiments of the present invention. The percentages are by weight; the temperature is room temperature, and the pressure is atmospheric.

EXAMPLE 1

In the distillation of Arabian paraffin base crude oil a diesel fuel oil having boiling points in the range from 150° to 280°C was taken out from the distillation column. This fraction had a flash point of 42°C and a cetane number of about 45. Moreover, the fraction had ac loud point of about −50°C. To 1000 kg of this diesel oil fraction were added 500 g of lauric acid, and the content of lauric acid of the diesel fuel oil was thus 0.05%.

The diesel oil presented excellent properties in respect of ability of burning with a low formation of smoke, and no wearing of the diesel oil pump could be observed. This diesel fuel oil was called Composition A.

EXAMPLE 2

To 1000 kg of the diesel oil fraction as obtained in Example 1 were added 300 g of palmitic acid. The content of additive of the diesel fuel was thus 0.03 per cent.

The diesel fuel oil thus obtained showed properties similar to those of the diesel fuel oil obtained in Example 1.

EXAMPLE 3

To 1000 kg of the diesel oil fraction as obtained in Example 1 were added 500 g of stearic acid. The content of additive of the diesel fuel oil was thus 0.05 per cent.

The diesel fuel oil thus obtained showed properties similar to those of the diesel fuel oil obtained in Example 1.

This diesel fuel oil was called Composition B.

EXAMPLE 4

To 1000 kg of the diesel oil fraction as obtained in Example 1 were added 300 g of stearic acid. The content of additive of the diesel fuel oil thus obtained was 0.03 per cent.

This diesel fuel oil showed properties similar to those of the diesel fuel oil obtained in Example 1.

This diesel fuel oil was called Composition C.

In order to obtain an idea of the progress of the present invention, a diesel fuel oil consisting of hydrocarbons boiling in the range of from 180 to 360°C was taken out by varying the conditions in the distillation column. This fraction had the following properties and thus also met the essential requirements of the specification in force.

Flash point	70°C
Cetane number	52-54
Cloud point	−10°C (maximum)

This composition was called Composition D.

To the diesel oil fraction obtained in Example 1 were added 2 per cent by volume of a lubricating oil type SAE 30. The mixture thus obtained was called Composition E.

The different compositions above referred to were each run on an internal diesel motor of test type, and the combustion gases obtained were examined in respect of content of smoke.

In this connection it proved that Compositions A-C showed a decidedly decreased formation of smoke, while Composition E, containing lubricating oil, in spite of having a boiling point interval displaced in a direction towards lighter and more volatile hydrocarbons, was quite unsatisfactory in respect of smoke formation when burning it in the diesel motor. Composition D consisting of relatively heavy hydrocarbons was considered quite unsatisfactory in respect of smoke formation.

The diesel motors were run for a period of at least 100 hours with each of the Compositions A-E. Compositions A-C and D did not give any damages in respect of the diesel pump details even after a running period of 1000 h. Composition E consisting of a hydrocarbon fraction boiling in the range of from 150 to 280° C containing lubricating oil gave rise to exceptional wearings of the movable parts of the diesel fuel oil pump even after 100 hours. This was also the case when using the hydrocarbon fraction as a diesel fuel oil without an addition of any agent whatever capable of improving the oiliness of the diesel fuel oil.

As there is no sure standard method for examining smoke-containing gases to determine their content of smoke, the inventors used a method which only gives relative values. For the purpose of testing the different diesel fuel oil to compare them mutually such a method would appear sufficient—the only essential requirement is that the experimental conditions are equal in all the cases.

The combustion gases from the test diesel motor were caused to pass through a tube having a photocell inserted. This photocell was graded in per cent, 100 per cent meaning that the gases passing along the photocell were free from smoke. The higher contents of smoke of the gases passing the lower were the turns of the scale of the photocell.

The degree of wearing in respect of the diesel fuel pump could be determined by

visual examination of the parts in combination with photographing.

For the experiments we have used diesel pumps of the type marketed by the German Company Robert Bosch, Stuttgart, the Swedish Company Injector, Stockholm, and British diesel pumps of the trade mark CAV, respectively.

The experiments thus prove that the use of the addition agents consisting of straight, saturated hydrocarbon carboxylic acids having a number of carbon atoms in the range as claimed results in specific and surprising effects which cannot be predicted by the skilled person.

Although we have described our invention by showing its application to specific examples, these are given for the purpose of illustration only and are not intended to limit the scope of the invention.

WHAT WE CLAIM IS:—

1. A diesel fuel oil composition having a decreased ability to form smoke upon combustion, comprising (a) mixture of hydrocarbons, wherein the bulk of the hydrocarbon mixture is composed of hydrocarbons having boiling points below about 300°C, and (b) a straight chain saturated aliphatic hydrocarbon carboylic acid containing from 12 to 18 carbon atoms in an amount ranging from 0.02 to 0.10 weight per cent, based on the weight of the entire diesel fuel oil composition.

2. A diesel fuel oil as claimed in claim 1, adapted to be used at low temperatures, wherein the straight, saturated aliphatic hydrocarbon carboxylic acid contains from 12 to 14, inclusive, carbon atoms.

3. A diesel fuel oil as claimed in claim 1, wherein the straight, saturated aliphatic hydrocarbon carboxylic acid contains from 12 to 14, inclusive, carbon atoms.

4. A diesel fuel oil, as claimed in claims 1, 2 or 3, containing in addition an addition agent capable of improving the cetane number.

5. A diesel fuel oil according to claim 1, substantially as hereinbefore particularly described with reference to any one of the Examples given.

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